

## Original Research Article

# Thoracodorsal artery perforator flap in immediate breast reconstruction: a series of twenty cases

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### ABSTRACT

**Background:** The management of breast cancer has shown a progressive change, from radical ablative surgery, to breast conserving techniques. Traditionally, the mini latissimus dorsi flap has been used for reconstruction; which is associated with donor site morbidity. Vascular research has now allowed the use of perforator-based flaps for reconstruction, which reduce donor site morbidity.

**Methods:** Twenty thoracodorsal perforator flaps in twenty early breast cancer patients were studied between January 2018 and December 2018. Parameters studied were adequacy of volume, ease and time taken for flap elevation, and final aesthetic outcome.

**Results:** Flap volume was adequate to fill defect. One of twenty cases had flap loss due to venous congestion secondary to pedicle kinking. Average time taken for flap elevation was 70.45 minutes. All patients were satisfied with cosmetic outcome.

**Conclusions:** The TDAP flap is a safe and reliable flap which provides adequate volume for partial breast reconstruction.

**Keywords:** Breast reconstruction, Oncoplastic surgery, Perforator flap

### INTRODUCTION

The management of breast cancer has shown a progressive change, from radical ablative procedures, to more conservative approaches. The development of advanced oncoplastic approaches has further widened the scope of breast conserving surgery. The approach to breast reconstruction after oncoplastic breast surgery can be divided into two categories; volume displacement, and volume replacement.<sup>1</sup> Volume displacement techniques involve reorienting breast parenchyma to fill the defect and are useful when tumor size is small relative to the breast tissue. Volume displacement techniques are used when tumor to breast ratio is larger.<sup>2,3</sup>

Traditionally, partial breast reconstruction has been performed using the mini latissimus dorsi (LD) flap.<sup>2</sup> This pedicled flap, while versatile, is associated with some morbidity at the donor site. Perforator based flaps were therefore developed to minimize this morbidity.

Current approaches to partial breast reconstruction include the thoracodorsal artery perforator (TDAP) flap, lateral intercostal artery perforator (LICAP) flap, lateral thoracic artery perforator (LTAP) flap, Anterior intercostal artery perforator (AICAP) flap, and the superior epigastric artery perforator (SEAP) flap.<sup>2,3</sup> This series studied the TDAP flap in immediate partial breast reconstruction after breast conserving surgery with

respect to duration of surgery, aesthetic outcome, and complications.

**METHODS**

A prospective series of twenty cases were studied at Vydehi Institute of Medical Sciences, Bangalore between January 2018 and December 2018. The study protocol followed the CONSORT guidelines. Patient demographic details were recorded. Twenty patients between 32 to 50 years (mean age was 42.45 years) planned for breast conserving surgery with inadequate tissue for volume displacement procedures were included in the study. All patients were cases of early breast carcinoma planned for breast conserving surgery and were willing for immediate reconstruction with volume replacement techniques. Institute Ethics Committee clearance was obtained prior to initiation of the series, and informed consent was taken from all patients after explaining the nature of the procedure, and the associated advantages and disadvantages.

All patients were operated by the same surgical team, comprising of surgical oncologists and plastic surgeons. All patients received 1 gm cefotaxime IV at induction of anaesthesia as per institute protocol. Patient characteristics are summarized in (Table 1).

Studied variables included flap dimensions, number of perforators found, duration of flap elevations, and complications. Results were tabulated and statistics were analysed using IBM SPSS Statistics.

**Table 1: Patient characteristics.**

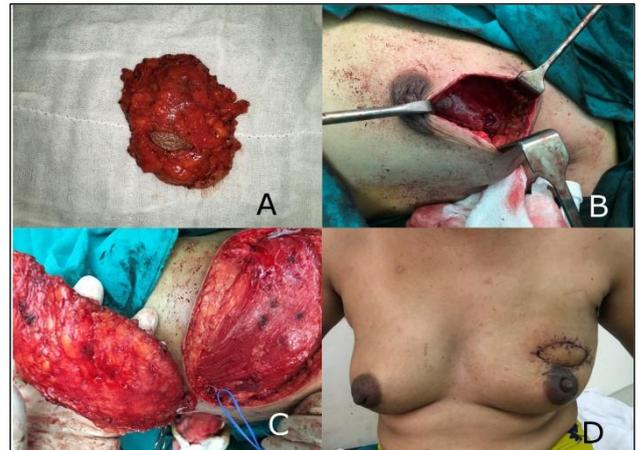
<b>Mean age in years (range)</b>	42.45 (36-50)
<b>Tumour location</b>	
Upper outer quadrant N (%)	11 (55)
Lower outer quadrant N (%)	1 (5)
Both upper and lower outer quadrant N (%)	8 (40)

**Flap design**

The anterior border of the latissimus dorsi muscle was palpated through the skin and marked with the patient in the standing position with both hands grasping the waist. The axillary crease was then marked. Preoperative perforator mapping was performed with a unidirectional Doppler probe (8 Hz) with the patient in the lateral decubitus position to simulate operative positioning. Perforators were sought out in a region 8cm below the axillary crease within 5 cm of the anterior border of the latissimus dorsi muscle.<sup>4</sup>

For breast reconstruction, the thoracodorsal artery perforator flap was oriented horizontally. This was to exploit the relaxed skin tension lines, and to ensure the final scar can be concealed under the straps of the bra.

Additionally, a vertically oriented skin paddle will shift the breast laterally.



**Figure 1: Case 1 (A) excised specimen, (B) defect, (C) TDAP flap elevated and (D) post-operative view.**



**Figure 2: Case 3 (A) location of tumour, (B) defect after excision, (C) flap elevated and (D) flap inset.**

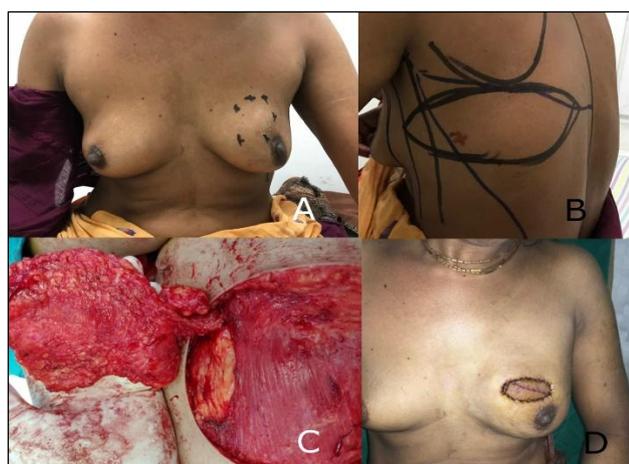


**Figure 3: Case 4 (A) location of tumour, (B) defect after excision, (C) flap elevation with minimal mobilisation and (D) flap necrosis secondary to congestion on post-op day 2.**

Skin incision was started at the antero-inferior border of the flap. This allowed the identification of the anterior border of the latissimus dorsi muscle and gave the flexibility of repositioning the anterior border of the flap accordingly. Incision was extended up to the area where perforator signal had been detected. Only visibly pulsatile perforators with a diameter greater than 0.5 mm were considered suitable and preserved. Those originating from the descending branch of the thoracodorsal vessels were chosen preferentially. Nerve branches to the latissimus muscle were freed from the pedicle. The flap was then dissected from the serratus fascia and from the latissimus dorsi muscle anteriorly. The flap was based totally on the thoracodorsal perforator and transposed into the defect (Figures 1-3).



**Figure 4: Case 5 (A) location of tumor, (B) flap marking (C) Flap elevation. Small amount of muscle included as perforator was not pulsatile (MS Type II) (D) 1-week post-op.**



**Figure 5: Case 12 (A) tumour location, (B) flap marking, (C) flap elevation, (D) flap inset.**

Two modifications exist when the perforator is less than 0.5 mm in diameter. MS Type I is where the perforator is less than 0.5 mm in diameter, but pulsatile. In these cases, a 2 mm cuff of latissimus dorsi muscle is preserved

around the perforators. MS Type II is when perforators are smaller than 0.5 mm, and non-pulsatile. In these cases, an approximately 5 cm segment of the latissimus dorsi muscle is included with the flap.

## RESULTS

A total of twenty TDAP flaps were performed in twenty patients for partial breast reconstruction. One of the twenty cases had venous congestion of the flap followed by necrosis. This flap could not be salvaged and was hence excised (Figure 4). The subsequent defect was filled with a pedicled latissimus dorsi flap, and skin defect close with a local Z-plasty. One patient developed a seroma at the recipient site which was managed conservatively without loss of flap. The remaining cases made an uneventful recovery.

Flap volume was adequate for partial breast reconstruction. Two cases warranted conversion to MS Type I flap as the isolated perforator was less than 0.5 mm, but pulsatile. Another case required conversion to MS Type II flap (Figure 5) as the perforator was less than 0.5 mm and non-pulsatile.

All patients but one had successful flap inset and were satisfied with the aesthetic outcome. Average time taken for flap elevation was 70.45 minutes (range: 55 to 96 minutes).

Results and complications are summarized in Tables 2 and 3.

**Table 2: Flap characteristics.**

<b>Mean flap dimensions</b>	7.45 cm × 14.5 cm
<b>Perforators</b>	
One N (%)	12 (60)
Two N (%)	5 (25)
MS type I N (%)	1 (5)
MS type II N (%)	2 (10)
Mean duration of flap elevation	74.45 minutes (55-96 minutes)

**Table 3: Complications.**

Complication	Number of cases (%)
<b>Seroma</b>	1 (5)
<b>Venous congestion</b>	1 (5)

## DISCUSSION

There are two main types of reconstruction after breast conserving surgery; volume displacement, and volume replacement. Large tumors in smaller breasts require volume replacement techniques for reconstruction, to maintain volume of the breast, as well as to prevent distortion, and subsequently poor aesthetic outcome.<sup>1</sup>

Better surveillance protocols, and increased patient education is beginning to see an increase in early diagnosis of breast cancer. This has consequently changed the trend from radical surgery to breast conserving techniques, resulting in an increased need for local flaps to fill defects after tumor ablation. Traditionally, the latissimus dorsi flap has been used to reconstruct defects after surgery, both, with or without implants.<sup>5</sup> This is associated with loss of function, seroma, and wound dehiscence. These associated complications of surgery have pushed for the development of perforator-based flaps which are associated with lower donor site morbidity.

Angrigiani et al, first reported the perforator anatomy and use of the free TDAP flap.<sup>6</sup> It has since been used for various reconstructions, both as a free, and pedicled flap. The pedicled TDAP flap is a versatile flap for reconstruction of defects of the anterior chest wall, breast, axilla, and around the shoulder. Flaps as large as 25×15 cm have been safely harvested, further increasing the utility of the flap.<sup>6-8</sup> In this series, the largest flap harvested was 9×14 cm, and this was not associated with any flap loss. The amount of flap volume provided by the flap was adequate to fill the defect in all these cases, precluding the need for larger flaps or implants.

Basing the flap on the distal perforators ensures easy reach to any of the quadrants of the breast.<sup>2,4</sup> In this series, all the defects were located in either the upper or lower outer quadrants, and the flap reached all of the defects with ease, and without any tension.

The thoracodorsal vessels provide a limited number of large perforators to the overlying skin.<sup>4,9</sup> Thomas et al, demonstrated around 5.5±1.8 perforators with a diameter greater than 0.5 mm supplying this flap.<sup>10</sup> However, only one or two of these are clinically useful. In this series, we were able to find one good perforator in majority of the cases. Since the original description of the thoracodorsal artery perforator flap by Angrigiani, the location of the majority of the perforators 8 cm distal to the posterior axillary fold has remained a valid, and important anatomical landmark during surgery.<sup>6</sup> Heitmann et al, further stated that the neurovascular hilus was found 3 to 6 cm inferior to the scapular tip, and 1 to 4 cm posterior to the anterior border of the latissimus dorsi muscle.<sup>11</sup> However, intra-operative positional changes, and skin laxity variations makes it prudent to locate skin perforators by Doppler examination prior to dissection.

Hamdi et al, popularised the use of the TDAP flap for both, partial, as well as selected cases of total breast reconstruction.<sup>2,4</sup> While traditionally raised as a vertical flap, the design of the skin paddle is modified to a transverse orientation to conceal the scar in the bra line.<sup>5</sup>

In this small series, we were able to locate the dominant perforator along the vertical branch in most cases. In cases with inadequately sized perforators, the flap was

converted to the muscle sparing variety. A transversely oriented skin paddle was used in all cases to conceal the final scar. Patients were satisfied with the aesthetic outcome in all cases. There was good symmetry with the opposite breast, and contralateral summarization was not required in any case.

There was total loss of one flap in this series. This was seen in the early part of the learning curve. The flap loss was caused by venous congestion secondary to kinking of the pedicle. This could possibly be explained by the incomplete mobilization of the pedicle as the defect was in close proximity; in essence, using it as a propeller flap. Due to the weight of the breast, there was possible traction or kinking of pedicle in the post-operative period as the patient moved. Following this complication, proper measures were taken in subsequent cases to ensure proper perfusion of the flap. These included complete mobilization of the pedicle, and proper fixation of the flap to prevent traction or kinking of the pedicle with changes in position. Flap elevation is meticulous and requires time. However, with increasing experience, time taken for flap elevation can be reduced.

While dissection is meticulous, and time consuming, there are many advantages of the flap. Minimization of muscle and nerve damage permits rapid functional recovery. A transversely oriented skin paddle follows the resting skin tension lines, which improves final aesthetic appearance of the scar. Post-operative volume reduction is minimal, as opposed to the latissimus dorsi flap, which can lose up to 30% of volume secondary to muscle atrophy. Incidence of complications such as seroma are lower, which can be up to 60% for the LD flaps.<sup>12</sup> In this series, we had one case of seroma formation, which was managed conservatively with aspiration.

## CONCLUSION

The TDAP flap is a safe and reliable flap which provides adequate volume for partial breast reconstruction, especially in the Indian scenario, where most patients do not want contralateral breast summarization that are often required after volume displacement procedures. The principle disadvantages are related to the need for meticulous dissection, which can increase the operating time. Additionally, careful handling of tissues, and proper care in positioning of the flap is essential to avoid kinking of the perforator. Preoperative Doppler imaging should be used for easier identification of perforators during surgery.

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